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## SIGNIFICANT RESULTS

ERTS-1 Project No. MMC-298

### ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY

Principal Investigator  
Dr. Duwayne M. Anderson - DE 329

E7.2 - 10370

CR-129826

Discipline 8: Interpretation Techniques Development  
Subdiscipline C: Classification and Pattern Recognition

Uncontrolled photo mosaics of ERTS-1 imagery using MSS band 5 and 7 at a scale of 1:1,000,000 were used to make a preliminary surficial geology map of approximately 59,000 square miles in north central Alaska. The area mapped is located between 65° -69° North latitude and 147° -156° West longitude. It covers a number of physiographic divisions of Alaska, from the Arctic Foothills on the north to the Koyukuk-Yukon Lowlands on the south.

Using stereographic mapping techniques, it was immediately apparent that more geologic detail could be seen on the photos than could be mapped at a scale of 1:1,000,000. All major geomorphic features such as mountain ranges, drainage patterns, glaciated valleys, moraines, modified morainal topography, thaw lakes, floodplains, alluvial fans and terraces, and eolian deposits were recognizable.

Seven distinct geologic units were recognized, defined and mapped directly on a photo mosaic. Selected portions were compared in detail with existing geologic maps. It was established that the results are closely correlated with published surficial geology maps.

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Eight ERTS-1 MSS images have been examined in detail to test the utility of ERTS data in studies of coastal processes and stream hydrology, and in the identification and interpretation of geomorphic features throughout Alaska. MSS image 1058-21421-7 of the southern coast of Norton Sound shows patterned ground in the swampy, lowland of the Yukon River delta. The distinct polygonal patterns are approximately 300-500 m across, and occur in a region generally underlain by moderately thick to thin permafrost (I<sub>2</sub>) according to Ferrians (1965). The unusually large size of these polygons is remarkable and of possible significance in relationship to Mariner 71 imagery showing, polygonal patterns on Mars (image number PLYBK P177, picture 35B). The relationship between coastal morphology and near shore currents is well illustrated in image 1010-22153-7 of the west coast of the Seward Peninsula. The predominant direction of flow along this coast is northerly as inferred from the orientation of the spits, baymouth bars, barrier islands, and cusate forelands along the shore. Meander scars, oxbow lakes, bars, sloughs, and chutes, formed by stream erosion or deposition are apparent in frame 1002-21324-7 of the Yukon River, 160 km northeast of Bethel. In image 110-20335-7 of the Wrangell Mountains, volcanic cones, calderas, and craters modified by glacial activity are well illustrated. A striking example of inversion topography with anticlinal valleys and synclinal hills is shown on MSS image 1010-22142-7. The Kukpowruk and Kikolik rivers in this scene are superimposed streams eroding across the geologic structures. Glaciers, glacial moraines, glacial valleys, hanging valleys, cirques, and aretes in the Wrangell and Chugach Mountains are clearly shown on image 1062-20221-7.

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The feasibility of using ERTS-1 data to map structural lineaments is well illustrated on a mosaic of 8, band 5 MSS images. This area covers 59,000 square miles and is bounded by longitudes W 147° - W 156°, latitudes N 69° - N 65°. Along the northern edge of the Brooks Range one lineament can be followed the entire width of the mosaic, a distance of 225 miles. Approximately 85 miles south, two nearly parallel lineaments can be seen. They run along the northern and southern edges of the Schwatka Mountains, extend for 225 miles and are 15-20 miles apart. In the Miscellaneous Geological Investigation Maps 1-459 and 1-554 a series of small faults have been mapped in the Koyukuk Valley and the Ambler Lowlands. These faults are visible as lineaments on ERTS images and due to the large area observed, the fault zones can be extended. About 135 miles south of the above lineaments another series located in the Chitanana River region, can be followed for 45 miles on image 1072-21182-5. These lineaments appear to be faults. At least three transverse faults and many drag folds are identifiable. It is interesting to note that the Yukon River parallels these lineaments and appears to be structurally controlled. This conclusion is verified by the Miscellaneous Geological Investigation Map 1-590 which depicts the Yukon River as following the Kaltag Fault.